I.2.2.1 Mini-frac Injection Test

A mini-frac injection test, using native or commercial brine, may be performed on the injection interval sand. A mini-frac analysis provides a method of estimating the formation fracture pressure as well as the fracture closure pressure of the potential storage formation. This type of analysis quantifies the fracturing process as estimated from the measured pressure decline. The main purpose of the mini-frac test, also known as a fracture diagnostic test, is to measure the formation fracture pressure which will help in designing the step-rate injection test (SRT - mentioned in the next section) that also measures the formation fracture pressure. This is necessary to eliminate/reduce errors that may occur during the estimation of formation fracture pressure using step rate test results, as the SRT analysis is a graphical technique.

The mini-frac test will also measure the fracture closure pressure, which is essential for understanding the in-situ minimum stress state of the rock. The formation fracture pressure is the upper limit of the fracture closure pressure so the determination of fracture closure pressure will help in detecting and estimating the fluid loss rates and fracture dimensions in the event of unintentional creation of fractures during actual CO_2 injection. It is also an important input to induced seismicity studies that require knowledge about the in-situ stress state of the formation.

For the purposes of this project, the mini-frac testing will be initiated with the injection of a small volume of fluid through an isolated section of perforated casing, creating a small fracture. Once the fracture has occurred, the injection rate will be stabilized. Following stabilization of the injection rate, injection will continue for fifteen to thirty minutes. After stable injection has been observed for the estimated time frame, the injection pumps will cease injection. If time and volumes allow, the injection pumps will be stepped down in equal time increments. This will allow for estimation of perforation and near-wellbore friction losses. The relationship between the decreasing rate and pressure results in a determination of near-wellbore pressure losses.

I.2.2.2 Step-rate Injection Test

A step rate injection test, using formation or commercial brine, may be performed on the injection interval sand. A Mini-frac pressure injectivity test (described in the previous section) may be performed ahead of the step rate test to assess receptivity of the potential injection interval. From these data, a detailed step rate test plan will be designed and